Beyond distribution maps: what citizen science reveals about protected insect species

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Citizen science initiatives are increasingly recognized as effective tools for collecting large-scale biodiversity data across a wide range of taxa, including insects. In Italy, over the past decade, 1,180 volunteers have contributed to the recording of protected insect species, yielding 5,968 validated occurrence records and documenting 6,292 specimens belonging to Coleoptera, Lepidoptera, Odonata, and Orthoptera.

Analyses conducted on nine species revealed a significant increase in distributional knowledge, without no evidence of spatial saturation. Such a result is observed both considering the growing numbers of newly occupied UTM 10x10 km cells, and the different shapes and densities of alpha-hulls polygons.

Beyond the distributional data, we explored the potential of these opportunistic photographic records for eco-ethological investigations, using 2,090 images of the beetle *Lucanus cervus*. Despite the absence of a standardized protocol, approximately 39% of records were suitable for behavioural interpretation, revealing sex-specific patterns consistent with literature: e.g., males mostly associated with flight and, in case of resting, with trunks or branches of trees, females mostly ground-dwelling, and mating pairs associated with dead wood.

Finally, to assess the educational and social dimensions of the project, a sociological survey covering 364 participants was conducted. Results identified two main volunteer profiles based on the number of records collected and the duration of participation. In addition, engagement resulted strongly linked to leisure, social interactions, and interest in science and conservation. Face-to-face communication emerged as a key entry point, while digital tools and social platform supported the long-term involvement.

Overall, this experience demonstrates how citizen science can simultaneously enhance scientific knowledge on protected insect species, support conservation planning, and foster public engagement and entomological education.